Space Weather Forecast

Issued on Tuesday, 09 May 2023 at 01:12 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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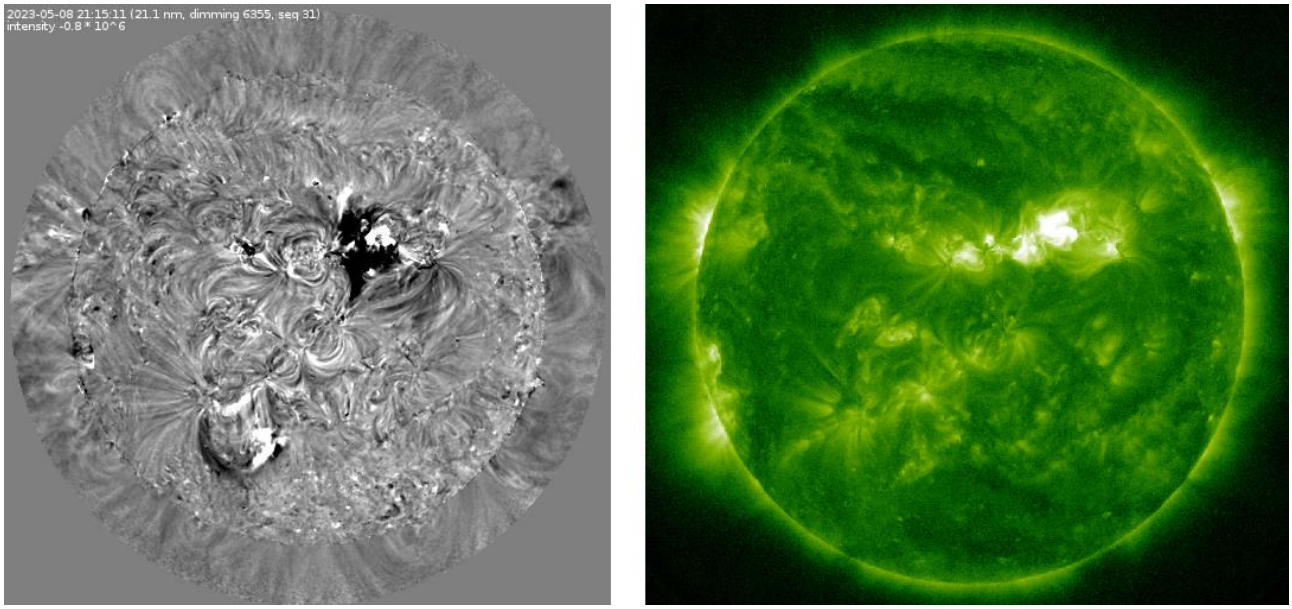
Space Weather Forecast Headline: G1/G2 Minor/Moderate geomagnetic storm expected late 10 into 11 May. S1/Minor Solar Radiation Storm expected through to midweek UTC, then most likely easing. Ongoing likely R1/R2 Minor/Moderate radio blackout risk.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained moderate over the past 24 hours, with activity bookended by the tail of the long-period moderate-class X-ray flare starting the 24-hour period, and a second slightly larger magnitude moderate flare at 08/2025UTC. Both of these flares emanated from the same sunspot region, which saw rapid development of its low-latitude intermediate spots and some associated growth.

Figure 1: Left: time-integrated extreme UV 'dimming' (often a sign of a Coronal Mass Ejection (CME)) associated with the 08/2025UTC moderate class flare (processing courtesy of SIDC ROB). Also shown is the same event in a false colour near X-ray wavelength, right. Any arising ejecta from this event is yet to be determined, pending imagery.



The above sunspot group was one of up to six on the current facing side of the Sun, with a small new magnetically bipolar region also developing in the northeast. A third sunspot group - the largest and nominally most complex - saw the emergence of a new high latitude spot around its main leader. The three other remaining groups on the Sun's facing side were less remarkable, all being magnetically unipolar, or else minor dipoles in decay.

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A Coronal Mass Ejection (CME) was associated with the peak moderate-class X-ray flare that narrowly preceded this 24-hour period. Although much of the ejecta appears to be directed to the northwest, an Earth-directed component is expected and has been modelled.

A minor 'filament' (arc of plasma) apparently erupted from the northwest at 08/1000UTC, although there was no obvious ejecta subsequently observed on satellite imagery.

Despite its apparently impulsive nature, a CME is considered a possibility from the late moderate-class flare. Imagery is pending for this event.

Solar Wind / Geomagnetic Activity: The solar wind was mainly suggestive of a fast wind. This became less clear-cut later in the period.

The solar wind rose from slightly elevated levels to reach an elevated peak, before moderating somewhat into the UTC evening. The magnitude of the magnetic field associated with the particles in the solar wind fell from a slightly elevated early peak, with the north-south component also becoming more constrained in its scope with time. The number of particles comprising the solar wind was also slightly elevated at times, with an early peak falling into background territory for a time, before a second short-lived peak around 13UTC, again moderating thereafter.

The net result of the above solar wind measures was below Minor Geomagnetic Storm G1 throughout.

Energetic Particles / Solar Radiation: Solar radiation rose from background to cross the S1 Minor Solar Radiation Storm threshold of 10pfu at 08/1145UTC, eventually peaking at 27pfu at 2330UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Isolated Moderate-class X-ray activity remains likely throughout the period, mainly from the recent most active sunspot and perhaps also the largest. None of the main front-sided regions leave the facing side in the period, and there are no major arrivals expected.

Solar Wind / Geomagnetic Activity: A full halo CME was observed in imagery with the moderate-class flare at 07/2323UTC. Although much of the ejecta appears to be directed towards the northwest an Earth-directed component is expected and has been modelled to arrive at Earth either on late 10 or early 11 May. In addition to this, a further CME candidate is awaiting imagery.

Earth is otherwise currently in a fast wind regime. Elevated to slightly elevated winds should ease to background through the first 48 hours of the forecast. A minor resurgence in the solar wind may occur late on 11 May due to yet another 'coronal hole' fast wind. Any impacts are expected to be weak based on 27-day persistence, in any case most likely swamped by the concurrent arrival of the CME (detailed above).

On 09 May quiet activity is expected, giving way to an expected G1-G2 (Minor to Moderate) geomagnetic storm, either late on 10 May or else early 11 May, with a slight chance of G3 (Strong) geomagnetic storm levels being reached. This risk should recede to perhaps a vestigial slight chance of G1 by day four, Friday 12 May.

Energetic Particles / Solar Radiation: Solar radiation is likely to remain above S1 on day one, Tuesday 09 May, with the duration now perhaps extended by further moderate-class X-ray activity from the most active sunspot, with this to be confirmed given the several-hour lag from emission to Earth arrival. The chances of S1 being maintained after midweek should fall - in the absence of further significant flare activity.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	80	80	20
Strong	G3	No	1	10	10	1
Severe	G4	No	1	3	3	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	70	70	70
Very Active	R3 to R5 X	No	15	15	15	15

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	100	40	25	20
Very Active	≥ S3 *	No	5	5	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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